IN THE UNIETED STATES PATENT AND TRADEMATRK OFFICE

Serial No.	: 09/844,533
Applicants	: Tatsuhito TAKAHASHI et al.
Filed	: April 27, 2001
For	: UNDER WATER IMMERSION BLOCK AND METHOD TO PRODUCE THE SAME
Art Unit	: 1755
Examiner	: Paul D. Marcantoni
Docket No.	: 01254C/HG
Confirmation No.	: 3735
Customer No.	: 01933

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313−1450

SIR:

The undersigned declares as follows:

1. I am a coinventor of the above-identified patent application.

2. I graduated from the University of Tokyo Institute of Technology in the year 1976, and I received the degree of Bachelor. I received the degree of Doctor in engineering from Tokyo Institute of Technology in the year 1996.

3. I have worked for NKK CORPORATION (now JFE Steel Corporation), Tokyo, Japan, since 1976, and I presently hold the position of staff general manager.

4. The following experiments, which show unexpected results for the presently claimed invention, were carried out under my supervision.

Concerning Table A (Experimental Result)
(How to prepare the marine block)

The marine block of Table A was prepared by using materials, which was basement for creating algae places. The algae places induce seeds and saplings to adhere and live on the surfaces of materials, naturally. The following Experimental Results shows that when the marine blocks were laid in existing algae planting places, marine algae adhered and lived on the surface of the marine blocks within a short period. Further, when the materials with algae living were moved as seeding materials to creating places and at the same time the newly materials (materials algae that did not adhere) were located around their circumstances, the marine algae as seeding materials increased on the circumferential materials. And, units of a community of algae, which has the algae planting places, were formed.

As a raw material of such marine blocks, the slag generated in the steel making process was at first treated in a metal removing treatment for removing the main metal content. At the same time, in the metal recovering process, the steel making slag was pulverized into a grain size of 50 mm or less. In the Experimental Results, the steel making slag was separated into two groups, which were 5-50 mm, and 5 mm or less.

The steel making slag such as the above-mentioned size, where CaO content was 50% and SiO_2 content was 15%, was piled 1 m in a pit of 1 m width x 1 m depth, and moderately tightened. Then the pit was closed and blown with carbon dioxide 0.96 Nm^3/hr for 5.5 days so as to solidify the slag. The carbonation-solidified slag was broken into an appropriate size to produce a lot of pieces of the block materials, which were used for the seeding materials and the basements of the algae planting place. The appropriate size was determined as the follqwing dimension. One was 1mW x 1mL x 1mH for the unit acreage sampling of to observe the growth of algae. And the other was 10 cm W x 10cm L x 2cm H. for observing adhering coral.

Such above-mentioned blocks were transported to the sea of a natural algae planting place, put in a pilling-up net, and was laid in the algae planting place, turning upward the fractured face.

Afterwards, under the conditions described on the bottom part of Table A, the marine blocks were immersed in the seawater for a determined duration.

As a result, the excellent experimental results (Example) were obtained which were distinguished from the Cement Concrete (Comparative Example), and which were clearly different from the Cement Concrete.

Such experimental results are shown in the following Table A.

Table A (Experimental Result)

		Example		Comparative Example	
		Marine Block		Cement Concrete	
Main material		Steel making slag		Portland cement Coarse aggregate Fine aggregate	
Component	CaO SiO2	50% 15%		Portland cement 64% 22%	
Grain size	>50mm 5–50mm <5mm	0% 15% 85%		0% 43% 57%	
Percentage of porosity (%)		Compressive strength(kg/cm2)	Growth of Algae	Compressive strength(kg/cm2)	Growth of Algae
	8	5		260	
	10	30		230	not good
	20	230	good	140	
	30	200	good	80	
	40	100	good	40	
	50	55		–	
	60	40		–	
	70	30		–	
	80	20		–	
Growth of Algae right after immersion after half a year passes		The number of adhering algae none(0 piece) 69 pieces		The number of adhering algae none(0 piece) 3 pieces	
Ahering of Coral	October	The number of adhering individual 67 pieces of individual		The number of adhering individual 29 pieces of individual	

Definition of compressive strength: Maximam compressive load for specimen to be durable

Cross section of the specimen, which is located to vertical direction of the compressive strength

Dimension of the specimen: 10cm diameter * 20cmH

Growth of Algae: Experimental condition

Jyogashima offing, Miura City, Kanagawa Pref.
Depth of water 7m. Ecklonia Place.
Immersion on November
The average number of Ecklonia was observed on the tme of half a year passage after immersion.
Note) the average number of Ecklonia (on the top face of the cube, whose dimention is 1mW * 1mL * 1mH)

Adhering of coral: Experimental condition

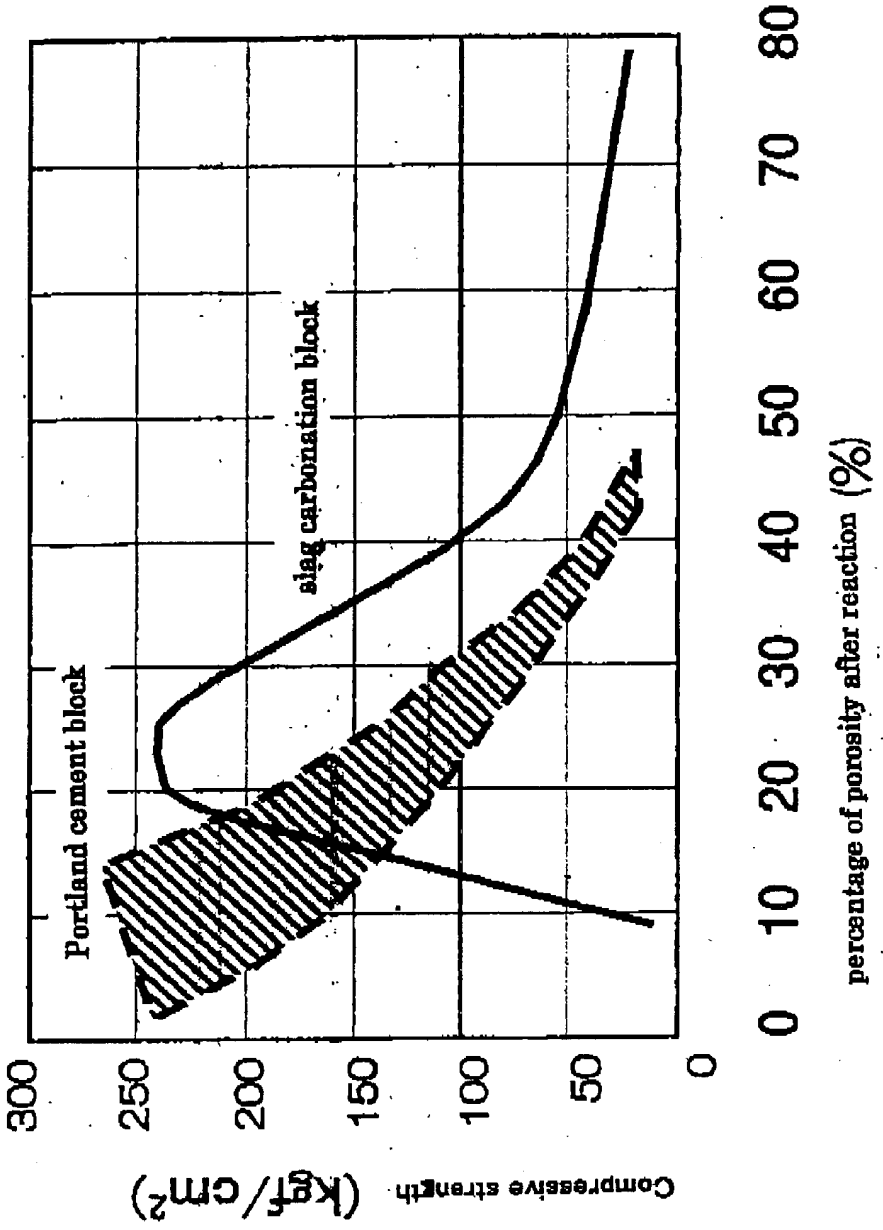
Okinawa Pref. Immersion on June. Observation on October
Total adhered number of coral polyp (both sides of 15 pieces of plate, which is equivallent to 30 faces. Dimension of each plate is 10cmW * 10cmL * 2cmH.)

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001, of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: February 4, 2004 By: Tatsuhito Takahashi

Name: Tatsuhito Takahashi

Table B Comparison concerning compressive strength between the porous concrete and the marine block



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An explanation of each photo

PHOTO A: REACTION MECHANISM AND THE MICROSTRUCTURE

This photo discloses one of advantageous technical specific features of the present invention. On the left part of the photo, the concerned model is drawn, which means, the reaction mechanism of the present invention. On the right part of the photo, the corresponding microstructure is attached, which means, a state of the combination of calcium carbonate and the slag in a shape of the network.

That is, a method for preparing agglomerates of solid particles containing at least one compound selected from the group consisting of CaO and $Ca(OH)_2$, contacting an exhaust gas containing CO_2 with the agglomerates of the solid particles in a reaction chamber, the solid particles having a film of adhesive water on a surface of the solid particles, fixing CO_2 in the exhaust gas as $CaCO_3$ to reduce CO_2 in the exhaust gas. (page 10, line 6 from the bottom, to page 11, line 5 from the top. of Specification in the present invention.) This film of adhesive water on a surface of the solid particles makes it easy to accelerate carbonation rapidly. This is one more great advantage of the present invention, focusing on the carbonation itself. As a result, the rapid growth of algae can be obtained in the present invention, compared with the cited prior arts.

PHOTO B: ADHERING PROPERTY AND REARING PROPERTY TO SLAG BLOCK (JYOGASHIMA)

This photo discloses how much degree the marine blocks in the present invention bring up the unexpected results, compared with the concrete block. On the left part of this photo, two sorts of pictures are followed up, which is, concerning the comparison of the adhering and rearing on the block. The observation was obtained when 7 months passed after immersing both of the marine block and the concrete block. Watching these two pictures, it is easily found out that the marine block of the present invention has a big deal of effectiveness, concerning the growth of algae. On the right part of the photo, the comparison between the number of Ecklonia on the top face of the block among the marine block of the present invention, the concrete block and the natural reef. The graph shows that the marine block of the present invention

is the best block to obtain a great deal of the number of Ecklonia.

PHOTOS C: MARINE BLOCK IMMESION TEST (Okinawa)

The photo shows that the marine block of the present invention obtains a good result of the adhering coral. Test area is Okinawa. The left part of the photo shows that a lot of amount of the adhering coral is observed compared with the immersion time. The photo on the upper part of the left side displays a state of the marine immersion block when the block was immersed. And the photo on the lower part of the left side displays how much degree the coral adhered to the marine block. The community made of 40 polyp was obtained. The right part of the photo is the comparison table about the number of the adhering coral, between the marine block and the concrete block.

PHOTO D: ENVIRONMENTAL IMPROVEMENT BY MARINE BLOCK

This photo shows one example of the construction structure by using the marine block in the sea. These photos were taken by Hiroshima Prefecture in Japan. On the right part of the photo shows that a various algae, which are Padina, Codium, Asparagopsis and Sargassum are breeding up.

PHOTO E: THE OBSERVED RESULT OF MARINE BLOCK IMMERSION TESTING IN THE ACTUAL SEA AREA (Jogashima)

This photo shows that the top surface of the marine block obtains much more amount of the growing algae adhered to the marine block, compared with the top surface of the concrete block. This photo was taken when the 7 months passed after the block was immersed into the actual sea area.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true ; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment , or both , under Section 1001 , of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon .

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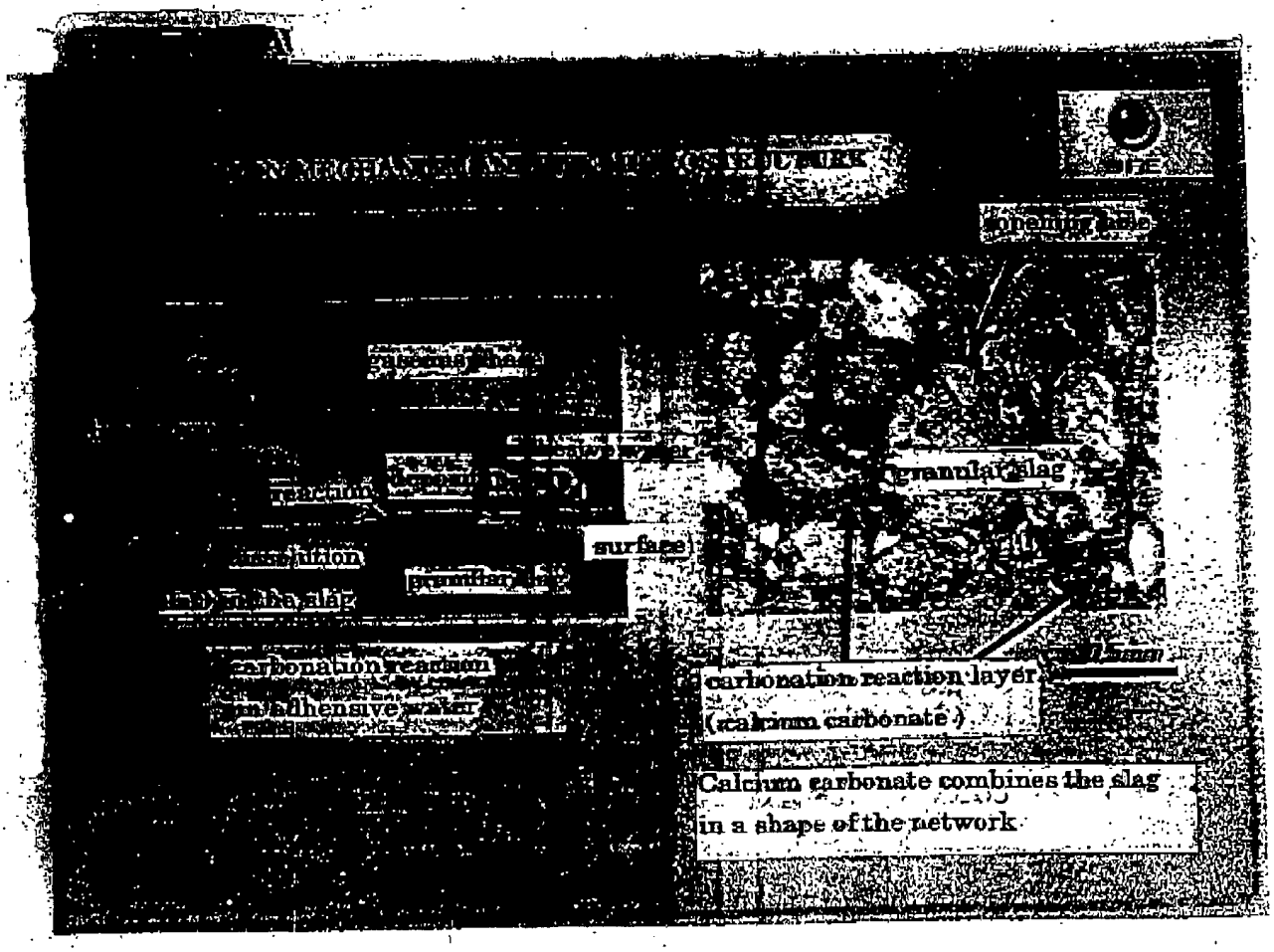

granular slag
surface
carbonation reaction layer
(calcium carbonate)
Calcium carbonate combines the slag
in a shape of the network

PHOTO 8

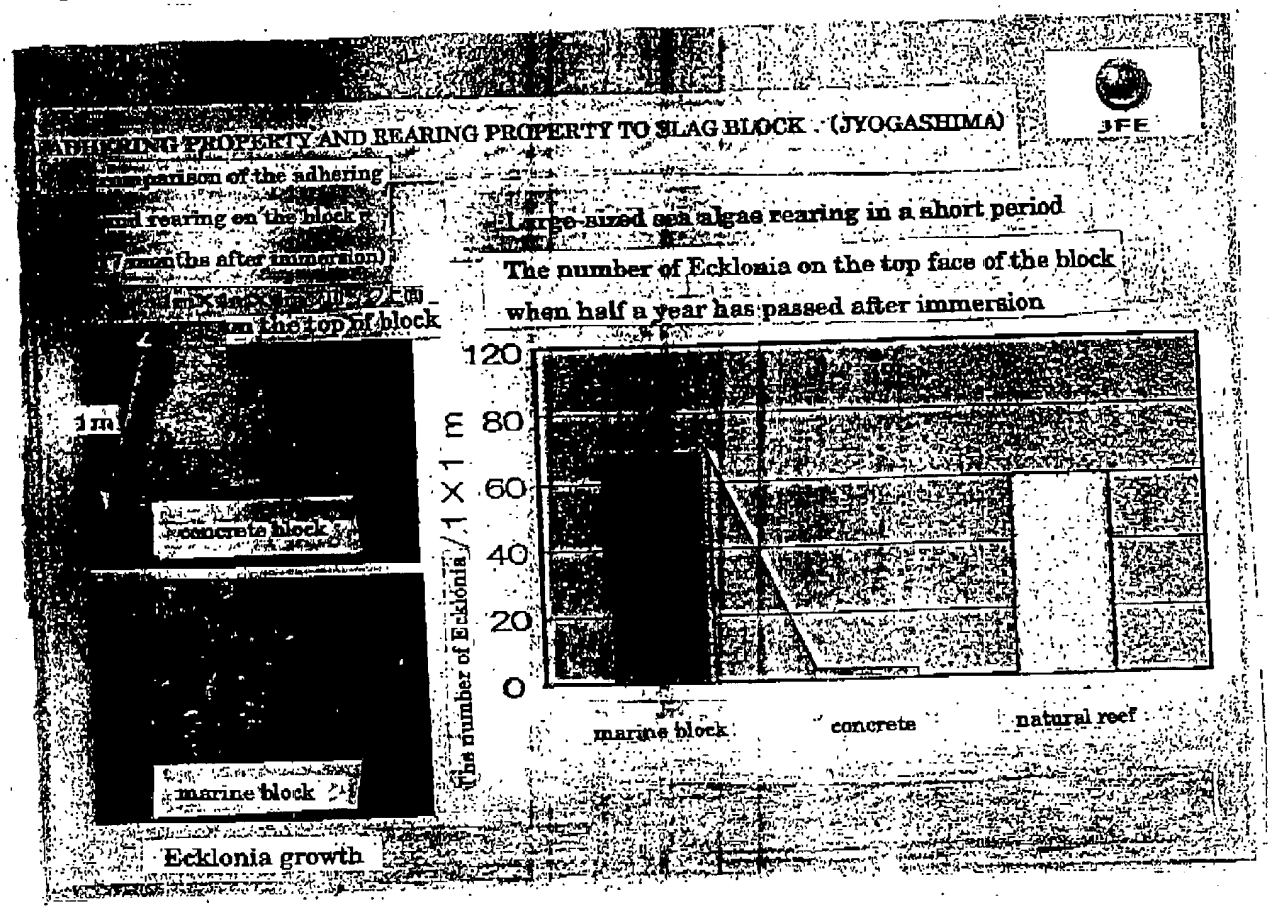
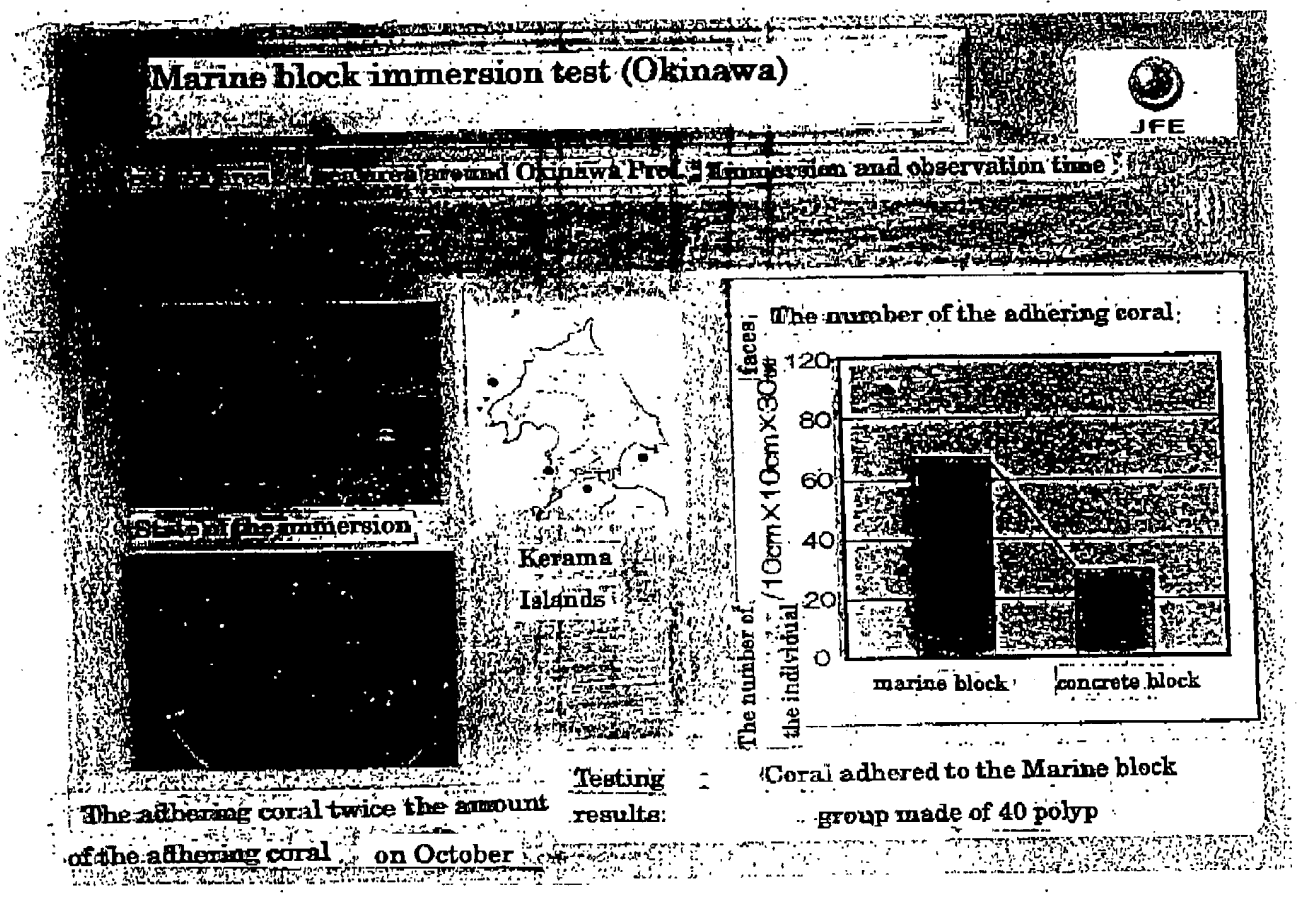
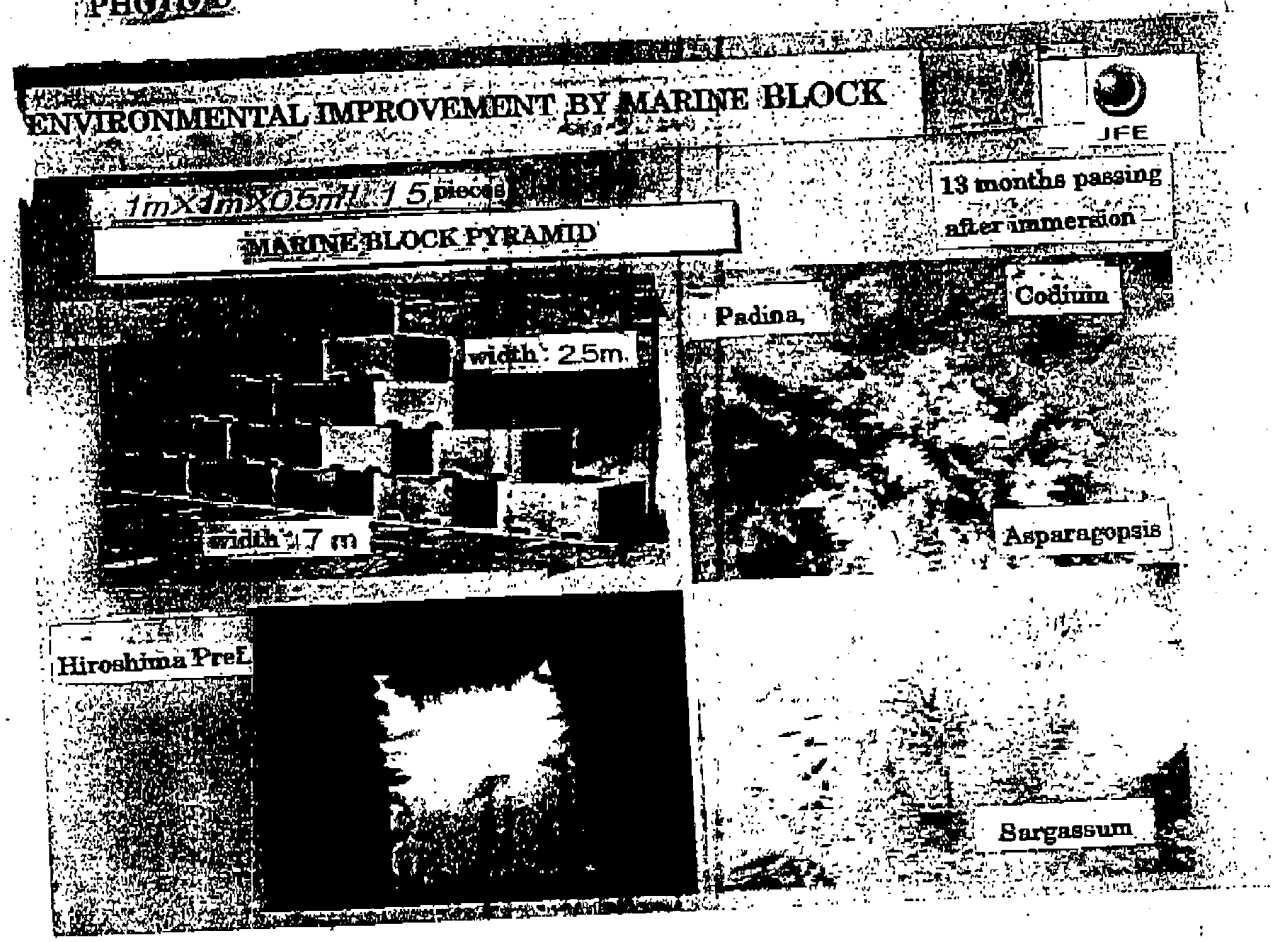

ADHERING PROPERTY AND REARING PROPERTY TO SLAG BLOCK (JYOGASHIMA)
JFE
Large-sized sea algae rearing in a short period
The number of Ecklonia on the top face of the block
when half a year has passed after immersion
1 m
concrete block
marine block
The number of Ecklonia / 1 X 1 m
120
80
60
40
20
0
marine block
concrete
natural reef
Ecklonia growth

PHOTO C



Testing sample : 5 sets of testing samples / sea area
fixing the marine blocks (5 pieces of 10cm square panel) with 5 pieces
of the concrete alternatively

PHOTO D


ENVIRONMENTAL IMPROVEMENT BY MARINE BLOCK
JFE
1mX1mX0.5mH: 15 pieces
MARINE BLOCK PYRAMID
13 months passing after immersion
width: 2.5m.
width: 7 m
Hiroshima Pref.
Padina
Codium
Asparagopsis
Sargassum

IN THE ACTUAL SEA AREA (ashima) IMERSION TESTING From: BARTH

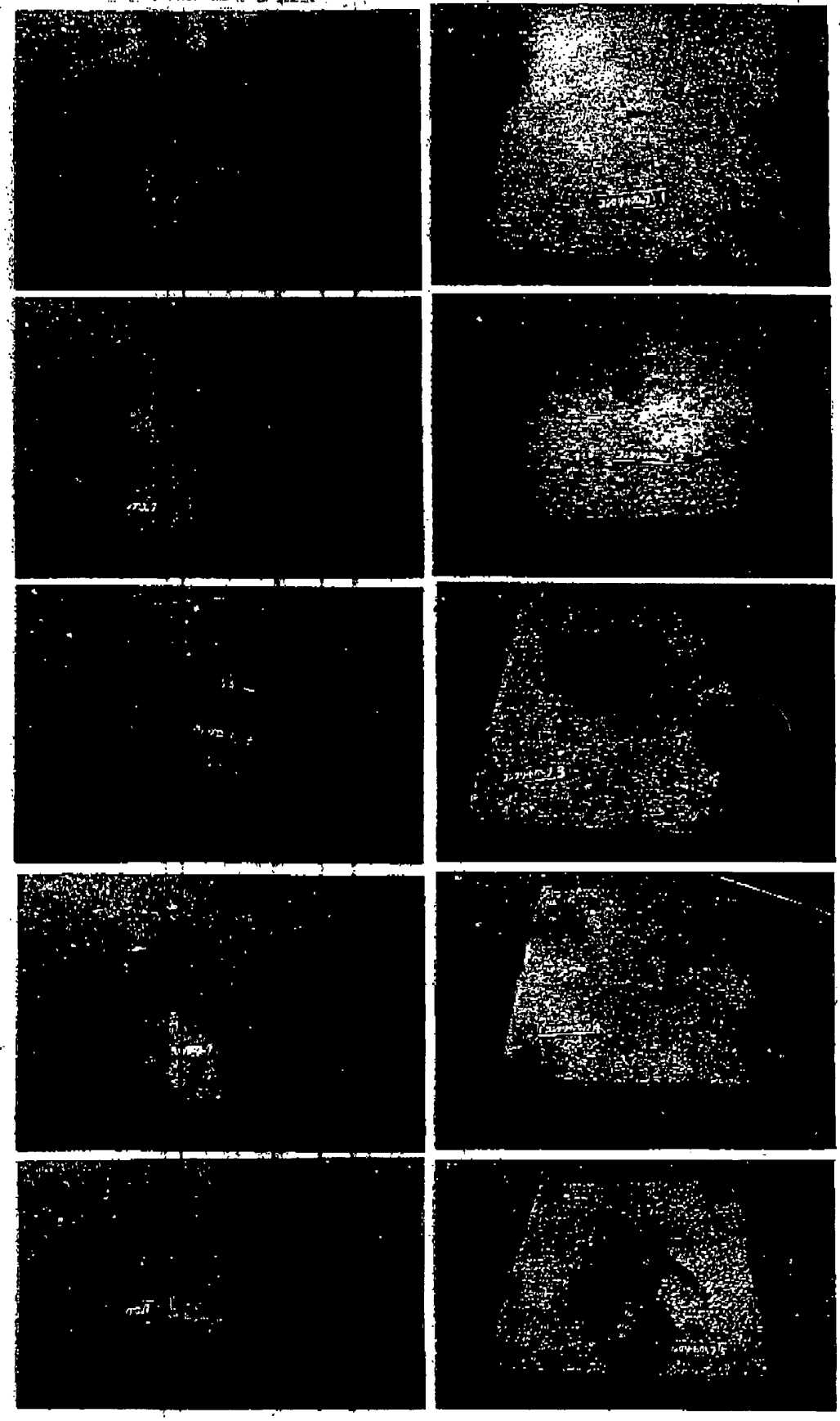
top surface of marine block

top surface of concrete block

7 months passing after immersion

depth of water 7m

1m×1m×1m



natural seaweed bed

wall face of rocky reef

depth of water 7m

M : marine block

C: concrete block